Conservation and Reproduction of an Endangered Species: the Broad-Headed Snake, *Hoplocephalus bungaroides* (Elapidae)

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ABSTRACT

This small elapid snake is endangered because of its restriction to a specific habitat (weathered sandstone outcrops in southeastern Australia) that is under heavy pressure for commercial exploitation, especially for "bushrock" in suburban gardens. We review the conservation status of this species, suggest strategies to maintain viable populations, and report consistent success in breeding this species in captivity.

Key words: Reptilia, Serpentes, Elapidae, Conservation, Habitat, Reproduction.

INTRODUCTION

Sandstone outcrops in coastal and near-coastal areas of southern New South Wales are the only known habitat for the Broad-headed Snake, a spectacularly-coloured medium-sized elapid snake (see photograph on front cover). Although this species is venomous, most specimens are sufficiently small (less than one metre total length) that adult human fatalities are unlikely. Nonetheless, at least two serious bites (one of them fatal) have been suffered by people who mistook adult Broad-headed Snakes for juveniles of the harmless Diamond Python *(Morelia spilota)*, which has a similar colour pattern and occurs in the same areas. Broad-headed Snakes are secretive, and generally nocturnal, emerging from their sandstone crevices at night to feed upon lizards and other small vertebrates (Shine 1983). Very little is known about the natural history and general biology of this species. In the present paper, we discuss the problems involved in conserving this species, and provide the first account of reproduction by Broad-headed Snakes in captivity.

Why is this species endangered?

There are many reasons why species are classed as "rare" or "endangered". Some taxa are placed in this category simply because they are restricted to habitats so remote and inaccessible that few specimens are ever collected, even though the animals may well be common where they occur. Other common and widespread species (such as the platypus) are perceived as "rare" because they are secretive and hence not often observed. Many of the genuinely rare species are those which have suffered directly as a result of human settlement in Australia, either through hunting, habitat destruction, or the depredations of feral animals such as cats and cane toads. For most reptiles and amphibians, it is *habitat destruction* which is the most important threat (Ehmann and Cogger 1985). Most of these animals are small and not particularly valued by hunters, so direct predation by humans is less significant than the continuing destruction of large areas of critical habitat. If the habitat is destroyed, the species will not be able to persist. The Broad-headed Snake is in a particularly difficult situation for three reasons:

(i) the southeastern coastal area in which it occurs also supports the highest densities of human population in the continent, so that habitat degradation has occurred on a massive scale. Although there are many National Parks in the range of the Broad-headed Snake, illegal habitat destruction has continued even within these areas (see below);

(ii) weathered sandstone outcrops along ridge tops are essential for this snake, especially the crevices formed by exfoliating layers of sandstone. Unfortunately, these same rocks are highly prized as decoration for home gardens, with the result that many outcrops have been torn apart by commercial collectors of "bushrock" (Hersey 1980). This problem is not a new one; the first book ever published on Australian snakes noted that the numbers of Broad-headed Snakes had already declined substantially because of habitat destruction and bush-rock collection for gardens (Krefft 1869);

(iii) snakes, especially venomous snakes, are not likely to raise the same warm sympathy as do the "cuddly" animals like koalas and kangaroos. Hence, many people see the conservation of reptiles as a less significant environmental issue than conservation of mammals or birds.

What can be done to conserve these animals?

Informed members of the general public can play an important role in helping to ensure that the Broad-headed Snake does not move closer to extinction. Here are a few suggestions:

(i) Talk to your friends about the importance of conserving ecosystems, not individual species. Many people tend to focus on one or two obvious (usually, large and furry) species, and think that the major problem is to save individual animals. This is rarely the case. If we want our grandchildren to enjoy a diversity of Australian wildlife, our best strategy is to conserve habitats where natural ecosystems can continue to function. This means taking care of the requirements of all components of these systems, including the generally "unpopular" animals like snakes.

(ii) Support the protection of wilderness areas and the creation of National Parks, and oppose any moves for destructive exploitation of such areas unless a thorough review indicates that this is an economically and environmentally sensible decision.

(iii) Don't buy "bushrock" for your backyard, especially the weathered rock that comes from natural outcrops. Old fallen logs offer an aesthetically pleasing alternative. If you really want to use rocks in landscaping, large and attractive sandstone boulders can be bought from quarries: they will take a little while to "age" and grow lichens, etc., but you will have the satisfaction of knowing that you haven't supported the destruction of critical habitat for a host of local wildlife species.

(iv) If you see a flatbed truck loaded with bushrock in a National Park or State Forest, record the truck's registration number and report it to the National Parks ranger. There have been several successful prosecutions, and the National Parks and Wildlife Service is anxious to stamp out these illegal destructive activities.

Captive breeding of the Broad-headed Snake

Relatively little is known about the general biology of most Australian snakes, and this is particularly true for rare species with restricted distributions like the Broad-headed Snake. The only detailed information available on this species came from dissections of preserved museum specimens to discover information on diets and reproductive biology (Shine 1983). There have been few first-hand observations on living specimens. Given the very limited funding available for herpetological research in Australia, how can one find out more about these animals? One profitable method may involve collaboration between professional research scientists and private reptile-keepers, with the support of the National Parks and Wildlife Service. Many private keepers have the interest and expertise to maintain rare species like the Broad-headed Snake in captivity, and can play a very useful role in furthering our knowledge of such animals. We have recently carried out exactly this kind of collaborative study and have had considerable success in encouraging reproduction of this endangered species in captivity.

We began with four specimens collected in 1986, and used for research on chromosomal variation within this species. When the research concluded, we were faced with the decision as to what to do with the specimens. They could not be released back into the bush, because they would eventually be needed as preserved "voucher specimens" in conjunction with the chromosomal data (so that future workers could check exactly what kinds of specimens had particular karyotypic configurations). However, the alternative — to kill the snakes and preserve them immediately — was very unpalatable, given the endangered status of the species. The National Parks and Wildlife Service agreed to an experiment — to let two private keepers maintain the snakes on behalf of the scientists, and to try and elicit reproduction in captivity. This would have the dual benefits of increasing our knowledge about the biology of Broad-headed Snakes, and assessing the feasibility of restocking natural areas with captive-reared juveniles.

The snakes were kept in a variety of cage types, mostly glass terraria with pegboard lids. Cage dimensions ranged from 40 × 25 × 25 cm to 60 × 30 × 30 cm. Each cage was heated and lighted by a 25-watt incandescent bulb, and was furnished with a hide-box, rocks and a water dish. All adult snakes were fed pre-killed laboratory mice or young rats, with the frequency of feeding varying from one or two items per month in winter, to three to five items per month in summer. All snakes maintained weight, or grew appreciably, on this rate of feeding. A photoperiod approximating that of Mullumbimby, New South Wales (28°30′S, 152°30′E) was maintained, with daytime ambient temperatures in the range 24 to 33°C and night-time temperatures permitted to fall no lower than 10°C. Juvenile snakes were maintained in well-ventilated plastic containers approximately 20 × 20 × 20 cm for the first few months of life, and fed on pre-killed day-old mice.

The Broad-headed Snakes have now reproduced every year since they were originally collected. Mating has been observed in spring (14 October 1986, 10 October 1987, 24 September 1988), with young being born in summer (13 January 1986, 28 February 1987, 11 March 1988, 24 February 1989). Litter sizes ranged from four to 12, but with a high proportion of infertile oocytes or stillborn offspring each year. The reasons for this phenomenon are under active study. The offspring are relatively large at birth compared to the size of the mother. For example, a female collected in the field in

April 1989 measured 68.5 cm snout-vent length (71 g after parturition) and gave birth to four young ranging in snouth-vent length from 21.8 to 22.7 cm, and in mass from 5.0 to 5.5 g. She also produced two infertile oocytes.

Our success in obtaining consistent reproduction in captive *Hoplocephalus bungaroides* suggests that captive propagation may be of some value in preserving the dwindling stocks of this endangered reptile. However, it cannot be a complete answer to the problem: there is little point in producing large numbers of juvenile snakes if there is no suitable habitat to which they can be returned. The continued survival of this species depends on several factors, but the most important is likely to be public attitudes towards conservation of large areas of sandstone habitats. We may be faced with a choice: would we rather have bushrock in our gardens, or an attractive and interesting component of our native fauna still roaming the Hawkesbury sandstone plateau?

ACKNOWLEDGEMENTS

We thank Leighton Llewellyn of the New South Wales National Parks and Wildlife Service for his understanding and cooperation in this work, Neville Burns for information and assistance, and Peter Harlow and Simon Blomberg for comments on the manuscript.

REFERENCES

EHMANN, H. AND COGGER, H. G., 1985. Australia's endangered herpetofauna — A review of criteria and policies. Pp. 435-47 in *Biology of Australasian Frogs and Reptiles* ed. by G. Grigg, R. Shine and H. Ehmann. Surrey Beatty & Sons and The Royal Zoological Society of New South Wales: Sydney.

HERSEY, F., 1980. Broad-headed Snake *Hoplocephalus bungaroides.* Parks and Wildlife, Endangered Animals of New South Wales. Ed. C. Haegl. N.P.W.S. Sydney.

KREFFT, G., 1869. The Snakes of Australia: An Illustrated and Descriptive Catalogue of All the Known Species. Thomas Richards, Govt. Printer: Sydney.

SHINE, R., 1983. Arboreality in snakes: Ecology of the Australian genus *Hoplocephalus. Copeia* **1983:** 198-205.

Emendations to the nomenclature of recently established palaeontological taxa

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It is necessary to correct several misconstructions that were presented in Archer (1982), Archer *et al.* (1987) and Archer (1988). These errors and their emendations are as follows and follow the proscriptions of Ride *et al.* (1985).

Archer (1982). Four subfamily names were established in this work: Murexinae Archer, 1982 (Archer 1982: p. 438); Phascolosorexinae Archer, 1982 (Archer 1982: p. 438-39); Planigalinae Archer, 1982 (Archer 1982: p. 439); and Sminthopsinae Archer, 1982 (Archer 1982: p. 439).

Of these the second was an incorrectly formed name (Articles 29(a) and 32(c)iii of the International Code of Zoological Nomenclature) that should be amended (Art. 32(d)) to Phascolosoricinae. The authorship and date of this justifiable emendation which is a correction of an incorrect original spelling (Art. 32(c)iii) should be that of the original publication (Art. 33(b)ii). Hence I here propose Phascolosoricinae Archer, 1982 as a replacement name for Phascolosorexinae Archer, 1982. The type genus for Phascolosoricinae Archer, 1982 is *Phascolosorex* Matschie, 1916. Features that distinguish members of the Phascolosoricinae from members of other dasyurid subfamilies are those cited by Archer (1982) for Phascolosorexinae.

Archer, Tedford and Rich (1987). In this work, a new family of possums, the Pilkipildridae, was established with two new genera and four new species. Both genera *Pilkipildra* and *Djilgaringa* were given feminine gender. The species names were all based on the surnames of female Australian palaeontologists (Dr Suzanne Hand, Ms Jennifer Taylor, Ms Anna Gillespie and Ms Betty Thompson) and hence should have received feminine endings. I propose the following alterations based on Art. 31(a) ii of the I.C.Z.N.: *Pilkipildra handae* Archer, Tedford and Rich, 1987 to replace *Pilkipildra handi* Archer, Tedford and Rich, 1987; *Pilkipildra taylorae* Archer, Tedford and Rich, 1987 to replace *Pilkipildra taylori* Archer, Tedford and Rich, 1987; *Djilgaringa gillespieae* Archer, Tedford and Rich, 1987 to replace *Djilgaringa gillespiei* Archer, Tedford and Rich, 1987; and *Djilgaringa thompsonae* Archer, Tedford and Rich, 1987 to replace *Djilgaringa thompsoni* Archer, Tedford and Rich, 1987.

Archer, Hand and Godthelp (1988). In this work the genus *Yalkaparidon* was established but without formal nomination of a type species which contravenes Articles 10(a), 13(b) and 69 of the I.C.Z.N. Accordingly, I here nominate *Yalkaparidon coheni* as the type species of *Yalkaparidon.*

ACKNOWLEDGMENTS

I am very grateful to Drs John Calaby, Colin Groves and George Kennedy for drawing my attention to these nomenclatural oversights.

REFERENCES

ARCHER, M., 1982. Review of the dasyurid (Marsupialia) fossil record, integration of data bearing on phylogenetic interpretation, and supragenerics classification. Pp. 397-443 in: *Carnivorous marsupials* ed by M. Archer. Royal Zoological Society of New South Wales: Sydney.

ARCHER, M., TEDFORD, R. H. AND RICH, T. H., 1987. The Pilkipildridae, a new family and four new species of ?petauroid possums (Marsupialia: Phalangerida) from the Australian Miocene. Pp. 607-27 in: *Possums and opossums: studies in evolution* ed by M. Archer. Surrey Beatty & Sons Pty Ltd and The Royal Zoological Society of New South Wales: Sydney.

ARCHER, M., HAND, S. AND GODTHELP, H., 1988. A new order of Tertiary zalambdodont marsupials. *Science* **239:** 1528-31.

RIDE, W. D. L., SABROSKY, G. W., BERNARDI, G. AND MELVILLE, R. V. (eds), 1985. "International code of zoological nomenclature adopted by the XX General Assembly of the International Union of Biological Sciences." International Trust for Zoological Nomenclature in association with British Museum (Natural History) and University of California Press: London.